REMARKS

This paper is presented in response to the non-final official action dated February 1, 2006, wherein: (a) claims 1-18 were pending; (b) claims 1, 8-10, and 14 were rejected under 35 USC § 103(a) as being obvious over Kalbitzer U.S. Patent No. 4,764,432 ("Kalbitzer") in view of Kusunoki U.S. Patent No. 5,336,904 ("Kusunoki"); (c) claims 1-3, 6-10, and 14-17 were rejected under § 103(a) as being obvious over Strain U.S. Patent No. 4,585,299 ("Strain") in view of Kalnitsky et al. U.S. Patent No. 4,934,774, ("Kalnitsky"); (d) claims 1-10 and 14-17 were rejected under § 103(a) as being obvious over Strain in view of Kalnitsky and Kase et al. U.S. Patent No. 5,145,794, ("Kase"); (e) claims 1-11 and 14-18 were rejected under § 103(a) as being obvious over Strain in view of Kalnitsky and Kase, further in view of Koblinger et al. U.S. Patent No. 4,980,317, ("Koblinger") and Coronel et al. U.S. Patent No. 5,930,585, ("Coronel"); (f) claims 1, 2, 7-10, and 14-16 were rejected under § 103(a) as being obvious over Dood et al. "Amorphous silicon waveguides for microphotonics," J. Appl. Phys., vol. 92(2), p. 649-53 ("Dood") in view of Kusunoki; (g) claims 1-3 and 6-18 were rejected under § 103(a) as being obvious over Dood and Kusunoki in view of Strain, Kalnitsky, and Kase; and, (h) claims 1-18 have been rejected under § 103(a) as being obvious over Dood and Kusunoki in view of Strain, Kalnitsky, and Kase, further in view of Koblinger and Coronel.

Reconsideration and withdrawal of the rejections are respectfully requested in view of the following remarks.

I. The 35 USC § 103(a) Rejections Are Traversed

Various combinations of claims 1-18 were rejected under 35 USC § 103(a) as being obvious over various combinations of the cited publications. A response to each of the obviousness rejections is set forth below.

A. Proper Basis for a § 103(a) Rejection

To establish a *prima facie* case of obviousness, the PTO must satisfy three basic criteria. First, the combined disclosure of the prior art references must teach or suggest all of the claim limitations. Second, there must be some suggestion or motivation to modify or combine the teachings in the art to make the precise combination recited in the claims. Finally, a person having ordinary skill in the art must have a reasonable expectation of success when combining or modifying the disclosures of the references. The suggestion or motivation to make the claimed invention and the reasonable expectation of success must both be derived from the prior art, and not from the application's disclosure. *See* MPEP §§ 2142-43 (8th ed., October 2005).

For a proposed combination or modification of cited publications, the prior art must suggest the desirability of the combination or modification. *In re Fulton*, 391 F.3d 1195, 1200 (Fed. Cir. 2004); MPEP § 2143.01(I). References cannot be combined where they teach away from their combination. MPEP § 2145(X)(D)(2). The mere fact that the prior art could be modified as proposed by the PTO is not sufficient to establish a prima facie case of obviousness. *See In re Fritch*, 972 F.2d 1260, 1266 (Fed. Cir. 1992). The PTO must explain why the prior art would have suggested to one of ordinary skill in the art the desirability of the modification. *Id.*; *In re Rouffet*, 149 F.3d 1350, 1357 (Fed. Cir. 1998) (indicating that "the examiner must show reasons that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination"); *In re Kotzab*, 217 F.3d 1365, 1371 (Fed. Cir. 2000) (indicating that "particular findings must be made as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected these components for combination in the manner claimed").

B. Rejection of Claims 1, 8-10, and 14 over Kalbitzer in view of Kusunoki

There is no motivation to modify the process disclosed by Kalbitzer in view of Kusunoki. Thus, no *prima facie* case of obviousness exits based on the combination of the applied publications for claims 1, 8-10, and 14.

Kalbitzer is directed to a photomask having regions of differing optical transmissivities. Regions of a crystalline silicon layer on the photomask are converted to amorphous silicon using an ion beam. *See* Kalbitzer, at abstract and col. 3, lines 36-40. When converting crystalline silicon into amorphous silicon, Kalbitzer teaches the use of "ions of medium and heavy atomic weight (atomic mass from about 30 upwards)." Kalbitzer, at col. 4, lines 8-9. Kalbitzer provides argon (atomic mass of 39.9) as an example of a suitable ion species (col. 4, lines 14-16), but provides no further instruction as to the factors influencing the choice of the atomic mass of the ion species.

Kusunoki is directed to a field effect element. Kusunoki teaches that "ion beams 26 of Ge [germanium] or Si [silicon] are irradiated to the surface of the substrate using the resist pattern 27 as a mask to form an amorphous silicon layer 2a." Kusunoki, col. 11, lines 33-36. Kusunoki provides no guidance as to the conditions under which germanium is preferred to silicon as the irradiating ion (or vice versa).

Claims 1, 8-10, and 14 recite the implanting of silicon into a crystalline silicon layer to form a selectively-amorphized silicon layer.

There is no motivation to modify the teaching of Kalbitzer by using silicon as the ion implant species (as taught by Kusunoki). Kalbitzer teaches the use of ions having an atomic mass of 30 and higher, while Kusunoki provides silicon (atomic mass of 28.1) and germanium

(atomic mass of 72.6) as possible ion species. Thus, Kalbitzer teaches away from the use of silicon ions, and Kusunoki provides no basis to conclude silicon is nonetheless acceptable in spite of Kalbitzer's explicit teaching. *See* MPEP § 2145(X)(D)(2). Assuming that Kalbitzer and Kusunoki were properly combinable in the first instance, the skilled artisan would only be motivated to use germanium ions, as such a choice would be consistent with both teachings.

C. Rejection of Claims 1-3, 6-10, and 14-17 over Strain in view of Kalnitsky

There is no motivation to combine the teachings of Strain and Kalnitsky, and, even if combined, they would not create a reasonable expectation of success. Thus, no *prima facie* case of obviousness exits based on the combination of the applied publications for claims 1-3, 6-10, and 14-17.

Strain is directed to a process for fabricating optical wave-guiding components. Strain discloses the ion implantation of arsenic, boron, germanium, or phosphorous dopants into a silicon substrate. *See* Strain, at col. 2, lines 65-68. The silicon substrate then undergoes an oxidation process to create a silicon dioxide light-confining element that completely surrounds the interior doped region. *See* Strain, at col. 3, lines 2-4 and lines 17-20.

Kalnitsky is directed to an optical waveguide. The waveguide is formed by first creating a silicon dioxide layer on a silicon substrate, and then implanting silicon ions into the silicon dioxide layer to create a Gaussian distribution of a stoichiometric excess of silicon. *See* Kalnitsky, at col. 3, lines 5-30.

Kalnitsky discusses Strain in its "Background of the Invention." Specifically, Kalnitsky indicates that, in the process disclosed by Strain, "migration of the [implanted ion] dopant during the oxide growth may be a problem." Kalnitsky, at col. 1, lines 66-68. Kalnitsky attempts to obviate or mitigate the problems associated with the method of Strain, among others. *See* Kalnitsky, at col. 2, lines 22-24.

Claims 1-3, 6-10, and 14-17 recite the implanting of silicon into a crystalline silicon layer (1) to form a selectively-amorphized silicon layer (claims 1-3, 6-10, and 14); (2) to form a crystalline layer comprising regions of amorphized silicon (claims 15 and 16); or (3) by a high-energy implantation process to form a selectively-amorphized silicon layer (claim 17).

There is no motivation to modify the teaching of Strain by using silicon as the ion implant species (as taught by Kalnitsky). The combination does not suggest the desirability of an amorphous silicon/crystalline silicon dopant system. Both Strain and Kalnitsky are directed to silicon dioxide-based waveguides; thus, they do not suggest the desirability of selecting silicon as the ionic species (from Kalnitsky) for implantation into a silicon substrate (from Strain) while omitting the creation of a silicon dioxide layer (the disclosed waveguide medium of both Strain and Kalnitsky). *See* MPEP § 2143.01(I). Further, the skilled artisan

would not be motivated to select silicon as the ionic species (from Kalnitsky) for implantation into a silicon substrate (from Strain) and then create a silicon dioxide layer, because Kalnitsky specifically chooses to implant ions into the silicon dioxide layer to avoid the problem of dopant migration that arises when creating a post-doping silicon dioxide layer. *See* MPEP § 2143.01(I). For this reason, a skilled artisan additionally would not have a reasonable expectation of creating a suitable waveguide if following this proposed method. *See* MPEP § 2143.02.

D. Rejection of Claims 1-10 and 14-17 over Strain in view of Kalnitsky and Kase

The combination of Strain, Kalnitsky, and Kase fails to teach or suggest all claimed features of the instant application. Thus, no *prima facie* case of obviousness exits based on the combination of the applied publications for claims 1-10 and 14-17.

Strain and Kalnitsky are discussed above.

Kase is directed to the formation of a shallow junction by ion implantation into a partially crystalline disordered region. Kase discloses the implantation of group III, IV, and V ions, and more specifically silicon and germanium ions, into a semiconductor substrate to suppress microchanneling of later implanted ions such as boron phosphorous, arsenic, and antimony. *See* Kase, at col. 1, line 36-66; and, col. 3, lines 57-63. Kase discloses the creation of an amorphous surface layer on the substrate; it does not disclose a selectively-amorphized silicon layer or a crystalline layer comprising regions of amorphized silicon.

Claims 1-10 and 14-17 recite the implanting of silicon into a crystalline silicon layer (1) to form a selectively-amorphized silicon layer (claims 1-10 and 14); (2) to form a crystalline layer comprising regions of amorphized silicon (claims 15 and 16); or (3) by a high-energy implantation process to form a selectively-amorphized silicon layer (claim 17).

The action asserts that "it would have been obvious to modify the process of forming a waveguide taught by Strain '299 by using Si ion doping first as taught by Kase et al. '794 to form preamorphized regions followed by the boron, arsenic, or phosphorous dopants to control diffusion." *See* the action, at 4. This proposed modification fails to teach or suggest a selectively-amorphized silicon layer or a crystalline layer comprising regions of amorphized silicon, as recited by all claims 1-18. These recited claim features refer to the spatial variation between amorpohous and crystalline silicon regions along the length of the optical device. *See, e.g.*, Fig. 1J. Kase teaches a spatial variation between amorpohous and crystalline silicon regions only in the depth direction. *See* Kase, at col. 3, lines 47-50. However, Kase teaches no lateral variation between amorpohous and crystalline silicon regions because it discloses in the singular only an amorphized "surface layer" and "a disordered [i.e.,

amorphized] region" on a semiconductor substrate. *See* Kase, at col. 1, lines 36-37; and, col. 3, lines 36-38.

E. Rejection of Claims 1-11 and 14-18 over Strain in view of Kalnitsky and Kase, further in view of Koblinger and Coronel

The combination of Strain, Kalnitsky, Kase, Koblinger, and Coronel fails to teach or suggest all claimed features of the instant application. Thus, no *prima facie* case of obviousness exits based on the combination of the applied publications for claims 1-11 and 14-18.

Strain, Kalnitsky, and Kase are discussed above.

Koblinger is directed to an etching method for producing semiconductor structures having field-effect transistors.

Coronel is directed to a collar etch method applied to DRAM chips.

Koblinger and Coronel are both cited in the action for their teachings related to etching steps and etching chemicals. *See* the action, at p. 4. Therefore, they do not remedy the deficiencies of the combination of Strain, Kalnitsky, and Kase with respect to the creation of a selectively-amorphized silicon layer or a crystalline layer comprising regions of amorphized silicon. *See* section I.D above. Thus, the combination of Strain, Kalnitsky, Kase, Koblinger, and Coronel does not teach or suggest all features of claims 1-18.

For this rejection, the action initially refers to Strain, Kalnitsky, and Kase, but later refers to the combination of "Strain '299, Kalnitsky et al. '774, and Lee et al. '640." *See* the action, at p. 4. It is presumed that the reference to "Lee et al. '640" is a typographical error and should instead refer to Kase.

F. Rejection of Claims 1, 2, 7-10, and 14-16 over Dood in view of Kusunoki

There is no motivation to modify the process disclosed by Dood in view of Kusunoki. Thus, no *prima facie* case of obviousness exits based on the combination of the applied publications for claims 1, 2, 7-10, and 14-16.

Dood is directed to amorphous silicon waveguides for microphotonics. Dood discloses the amorphization of crystalline silicon by irradiation with xenon ions. *See* Dood, at p. 649. Dood provides no teaching with respect to the reason xenon was selected as the implanted ion, nor does it disclose possible alternatives to xenon.

Kusunoki is discussed above.

Claims 1, 2, 7-10, and 14-16 recite the implanting of silicon into a crystalline silicon layer (1) to form a selectively-amorphized silicon layer (claims 1, 2, 7-10, and 14) or (2) to form a crystalline layer comprising regions of amorphized silicon (claims 15 and 16).

The combination of Dood and Kusunoki fails to suggest the desirability of implanting silicon into combination into a crystalline silicon layer to form a selectively-amorphized silicon layer or to form a crystalline layer comprising regions of amorphized silicon. Dood discloses the use of xenon to amorphize silicon in a waveguide and Kusunoki discloses the use of germanium or silicon to amorphize silicon in a field effect element. *See* above. Neither Dood nor Kusunoki provides any instruction as to the selection of the implanted ion species (i.e., xenon, germanium, or silicon). Thus, there is no reason why a skilled artisan would select silicon as the implanted species (from Kusunoki) for use in the waveguide of Dood. *See In re Rouffet*, 149 F.3d at 1357.

G. Rejection of Claims 1-3 and 6-18 over Dood and Kusunoki in view of Strain, Kalnitsky, and Kase

There is no motivation to modify the process disclosed by Dood and Kusunoki in view of Strain, Kalnitsky, and Kase. Further, even if combined as suggested in the official action, the publications do not teach or suggest all claimed features. Thus, no *prima facie* case of obviousness exits based on the combination of the applied publications for claims 1-3 and 6-18.

All of the cited publications have been discussed above.

Claims 1-3 and 6-18 recite the implanting of silicon into a crystalline silicon layer (1) to form a selectively-amorphized silicon layer (claims 1-3 and 6-14); (2) to form a crystalline layer comprising regions of amorphized silicon (claims 15 and 16); or (3) by a high-energy implantation process to form a selectively-amorphized silicon layer (claims 17 and 18).

The combination of Dood and Kusunoki fails to suggest the desirability of implanting silicon into combination into a crystalline silicon layer to form a selectively-amorphized silicon layer or to form a crystalline layer comprising regions of amorphized silicon. *See* section I.F above. Furthermore, even if Dood and Kusunoki were supplemented by Strain, Kalnitsky, and Kase in the manner suggested by the action, the result would not be a selectively-amorphized silicon layer or a crystalline layer comprising regions of amorphized silicon. *See* section I.D above.

H. Rejection of Claims 1-18 over Dood and Kusunoki in view of Strain, Kalnitsky, and Kase, further in view of Koblinger and Coronel

There is no motivation to modify the process disclosed by Dood and Kusunoki in view of Strain, Kalnitsky, and Kase, further in view of Koblinger and Coronel. Further, even if combined as suggested in the official action, the publications do not teach or suggest all claimed features. Thus, no *prima facie* case of obviousness exits based on the combination of the applied publications for claims 1-18.

All of the cited publications have been discussed above.

Claims 1-18 recite the implanting of silicon into a crystalline silicon layer (1) to form a selectively-amorphized silicon layer (claims 1-14); (2) to form a crystalline layer comprising regions of amorphized silicon (claims 15 and 16); or (3) by a high-energy implantation process to form a selectively-amorphized silicon layer (claims 17 and 18).

Because Koblinger and Coronel are both cited in the action for their teachings related to etching steps and etching chemicals, they do not remedy the deficiencies of the combination of Dood, Kusunoki, Strain, Kalnitsky, and Kase, with respect to the implantation of silicon into a crystalline silicon layer to create a selectively-amorphized silicon layer or a crystalline layer comprising regions of amorphized silicon. *See* section I.G above.

I. Additional Basis for Withdrawal of the § 103(a) Rejections

For each of the various rejections, the official action sets forth which elements are disclosed in the various publications, but only makes the conclusory statement that "it would have been obvious to modify" the cited publications in the manner proposed in the action. *See* the action, at p. 2-6. Thus, the action fails to "show reasons that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in manner claimed." *In re Rouffet*, 149 F.3d at 1357. Without this showing, there is the inference that the rejections are based on impermissible hindsight. *See id.* at 1358. Accordingly, the rejections should be withdrawn.

Given these shortcomings, it is respectfully submitted that the claimed invention is unobvious. Accordingly, reconsideration and withdrawal of the rejection are requested.

CONCLUSION

In view of the foregoing, reconsideration and withdrawal of the rejections, and allowance of all pending claims 1-18 are respectfully requested.

Should the examiner wish to discuss the foregoing, or any matter of form or procedure in an effort to advance this application to allowance, the examiner is urged to contact the undersigned attorney.

Respectfully submitted,

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